DOCUMENT RESUME

ED 077 882 SP 006 563

AUTHOR Gall, Meredith D.
TITLE What Effect Do Teachers' Questions Have on Students?
INSTITUTION Far West Lab. for Educational Research and Development, San Francisco, Calif.
PUB DATE Feb 73
NOTE 10p.; Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, Louisiana, February 1973

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Concept Formation; *Reactive Behavior; *Student Reaction; *Student Teacher Relationship; *Teacher Influence; *Thought Processes

ABSTRACT

The author describes ways to test for relationships between student achievement and higher cognitive questions asked by the teacher. He details methods for evaluating student responses in terms of answer quality and presents some of his own preliminary research on student response length. Higher cognitive questions, he hypothesizes, elicit and shape thought processes which manifest themselves in oral responses. Three tables of data are presented. (JB)

ED 077882

WHAT EFFECT DO TEACHERS' QUESTIONS HAVE ON STUDENTS?

Meredith D. Gall

Far West Laboratory for Educational Research and Development

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SP 006 563

Paper presented at the annual meeting of the American Educational Research Association, New Orleans, February 1973

FILMED FROM BEST AVAILABLE COPY

WHAT EFFECT DO TEACHERS' QUESTIONS HAVE ON STUDENTS?

Meredith D. Gall

Far West Laboratory for Educational Research and Development

In a literature review of questioning research a few years ago (Gall, 1970), I concluded that the time was ripe to focus our research efforts on investigating the effects which teachers' questioning practices have on student behavior. The majority of previous research has concentrated on descriptive analysis of teachers' questions or evaluation of training programs designed to change question-asking behavior. Much useful knowledge has resulted from these studies, but the value of this knowledge depends ultimately upon our ability to demonstrate that teacher questions help students to learn. What is the point of training teachers in techniques of questioning unless these techniques bring about demonstrable student learning?

Barak Rosenshine's review of correlational research on teacher effects (1971) revealed few statistically significant or consistent relationships between student achievement gains and teacher use of higher cognitive questions[1] or probing questions.[2] However, in the studies with which I am familiar, an inappropriate paper-and-pencil test was used to assess student learning. For example, in Wright and Nuthall's study (1970) a multiple-choice test was used to assess students' mastery of facts after having been taught a curriculum unit. Not surprisingly, the teachers' percentage of higher cognitive questions showed a slight negative correlation with this criterion. If a paper-and-pencil, multiple-choice test is an inappropriate measure for assessing the effects of higher cognitive questions, what would constitute a suitable measure? To my knowledge, there are no suitable measures currently available. In the following sections I will sketch the types of measures which I believe need to be developed in order to validly assess effects of higher cognitive and probing questions on student learning.

---

1 Higher cognitive questions require students to think, for example, to analyze situations, solve problems, state opinions, or make predictions. They can be contrasted with fact questions, which require only recall of information or simple observation.

2 Probing questions are designed to improve a student's initial response to another question.

Within-Discussion Effects

We can start our search for effects of higher cognitive and probing questions within the discussion process itself. Suppose that a teacher asks the higher cognitive question, "Why do you think ecology has become so popular recently?" If the question has its presumed effect, it will cause the student to think of reasons to explain this phenomenon. However, since thought processes cannot be observed directly, we need to look for indirect effects in the characteristics of his verbal response.

What characteristics should we assess? Unlike fact questions, I do not believe that higher cognitive questions have single correct answers, so they cannot be scored simply as correct or incorrect. However, the answer could be scored for content. In the example above, we could score the student's answer for presence or absence of one or more "reasons" to explain the current popularity of ecology. I believe it is also desirable to score the answer for quality. Was it a good, satisfactory or poor answer?

In the past a few studies have indirectly assessed the quality of a student answer by measuring its length (number of words). The assumption is that longer answers reflect more thought and verbal fluency than short answers. To my knowledge this assumption has not been empirically tested. However, I do have data which tests a related hypothesis: if higher cognitive questions indeed elicit thought whereas fact questions do not, and if length of an answer reflects the presence of thought, student answers to higher cognitive questions should be longer than their answers to fact questions. The data presented in Table 1 (from Gall, Dunning, Galassi, and Banks, 1970, pp. 41-42) substantiate this hypothesis.

Although length of a student response may be a rough index of quality, more direct measures are needed. The following list of seven criteria may comprise some of the components which determine quality of response:

1. CLARITY	The student answers in understandable English without mumbling, failing to finish, or confusing his thoughts.
2. ACCURACY	The student's answer contains no factual errors and is based on accurate information.
3. APPROPRIATENESS	The student answers the question that was asked.
4. SPECIFICITY	The student clearly identifies who and what he is talking about.
5. SUPPORT	The student gives reasons, facts, or examples to support his statement, or he explains the criteria or assumptions on which he bases his opinion.

TABLE 1

LENGTH OF STUDENT RESPONSE TO FACT AND HIGHER COGNITIVE QUESTIONS

TREATMENT GROUP	MEAN NUMBER OF WORDS[1]	
	FACT QUESTIONS	HIGHER COGNITIVE QUESTIONS
4-6th Grade Teachers Before Training		
Experimental Group 1	9.5	15.0
Experimental Group 2	7.4	11.3
Control Group	7.8	11.5
4-6th Grade Teachers After Training		
Experimental Group 1	7.8	15.6
Experimental Group 2	8.0	13.2
Control Group	8.7	13.2
7th Grade Teachers Before Training		
Experimental Group 1	9.1	16.0
Experimental Group 2	11.0	19.4
Control Group	7.0	11.9
7th Grade Teachers After Training		
Experimental Group 1	12.7	18.9
Experimental Group 2	11.3	17.8
Control Group	9.2	13.2

[1] The individual student response was the unit used in computing the mean. The range of N's for the means presented here is 137-744.

6. COMPLEXITY	The student's answer shows that he is aware that there are many ways of looking at the problem being discussed, and that they must be considered before a valid judgment can be reached.
7. ORIGINALITY	The student draws upon current knowledge and past experience to create or discover ideas that are new to him.

(Gall, Dunning, and Weathersby, 1971)

To my knowledge, these criteria have not yet been validated to determine their usefulness in rating quality of student answers.

Probing questions, properly used, should improve the quality of a student's initial response. Suppose that in response to the question, "Why do you think ecology has become so popular recently?", a student answers, "Because people are becoming more aware of how they're mistreating nature." The teacher could probe this response to improve its quality by asking questions such as, "What people are you referring to?", "What do you mean by 'mistreating'?", or "What are some examples?" Probably the same quality measure used to assess the effect of higher cognitive questions could be used to assess the effect of probing questions. Also, as with higher cognitive questions, length of response might be used as a rough index of quality of response to probing questions. In a recent study of preservice teachers (Saunders, Gall, and Smith, 1973), we tested the hypothesis that probing questions, properly used, will take an initially weak response and improve its quality, as measured by length. The data presented in Table 2 provide strong support for this hypothesis.

Post-Discussion Effects

If a student has learned from a discussion, it should be manifest in his behavior after the discussion has ended. If the student listened to his peers, he should have acquired a number of ideas not his own about questions raised by the teacher. Thus, one effect of a teacher's higher cognitive question, particularly when redirected to several students, might be to increase the student's repertoire of ideas pertaining to that question. Another effect might be that the student is able to give a higher quality answer to a given question after the discussion, if that question was covered in the discussion. The rationale for this hypothesized effect is that a good discussion provides the student with the opportunity to a) respond to the question, b) have his response challenged by a probing question, and/or c) listen to another student's response. A third effect of the discussion might be to change or modify the specific content of the student's response to a question; that is, he might hold to a different

TABLE 2

LENGTH OF STUDENT RESPONSE PRIOR TO AND FOLLOWING PROBING QUESTIONS

TREATMENT GROUP	NUMBER OF TEACHERS	NUMBER OF PROBES	MEAN NUMBER OF WORDS	
			PRE-PROBE	POST-PROBE
(Before Training)[1]				
Group 1	13	11	4.6	13.7
Group 2	14	9	7.1	16.9
Group 3	15	16	13.1	15.1
Group 4	13	13	6.7	14.2
Group 5	12	4	10.5	15.5
Group 6	16	10	4.6	11.7
(After Training)				
Group 1	13	39	10.3	16.0
Group 2	14	26	7.7	15.5
Group 3	15	27	6.9	18.6
Group 4	13	25	13.7	15.9
Group 5	12	13	8.2	12.8
Group 6	16	19	6.8	9.4

[1] Training involved different methods of instruction in use of higher cognitive and probing questions.

prediction, reason, opinion, generalization, or solution after the discussion than before.

How would we measure these effects? First, it would be necessary to test each student by himself or herself, since learning occurs in the individual, not in the group. The test could consist of eliciting the student's response to the same set of questions before and after the discussion; of course, this set of questions should be derived from those asked by the teacher during the discussion. Since the teacher's use of questioning techniques presumably shapes and improves students' oral responses, the criterion test should also elicit oral responses.[1] To determine whether improvement in quality of oral discourse transfers to the written mode, the student could be tested by having him write essay-type answers to higher-cognitive questions asked by the teacher in the discussion.

Long-Term Effects

Thus far I have been concerned with immediate effects of a teacher's use of higher cognitive and probing questions in a particular discussion. If a teacher makes habitual use of these techniques, what would the effect be on students? Suppose that a teacher uses these techniques in a discussion situation twice a week for four months. If a discussion in the first week is compared with a discussion in the last week of this time period, I predict that the quality of student responses and amount of learning would be greater in the later discussion.

An Experiment

An experiment to test the various effects which I have described above is represented schematically in Table 3. Experimental teachers are persons who naturally or by training make frequent use of higher cognitive and probing questions. Control teachers are persons who make infrequent or no use of these techniques. The data collected using this experimental design could be analyzed to test the following hypotheses:

a. Experimental teachers will elicit more high-quality student responses than control teachers. Compare X_2 with Y_2.

---

[1] In previous research teacher use of oral questioning techniques has been correlated with students' written performance. This design flaw probably accounts in part for some of the negative results that have been reported.

TABLE 3

EXPERIMENTAL DESIGN TO TEST FOR CHANGE IN QUALITY OF STUDENT RESPONSE

TEST OCCASION	EXPERIMENTAL GROUP	CONTROL GROUP
Immediate Pretest	X_1	Y_1
Discussion	X_2	Y_2
Immediate Posttest	X_3	Y_3
Interval of time during which experimental teachers make habitual use of higher cognitive and probing questions.		
Immediate Pretest	X_4	Y_4
Discussion	X_5	Y_5
Immediate Posttest	X_6	Y_6

b. Students of experimental teachers will learn more from a given discussion than students of control teachers. Compare experimental group gain from pretest to posttest (X_3-X_1) with control group gain (Y_3-Y_1).

c. With repeated exposure to higher cognitive and probing questions, students will improve their ability to respond in discussion situations (compare X_5 with X_2) and will learn more from the discussion (compare X_6 with X_3). Students of control teachers will not gain (compare Y_5 with Y_2, and Y_6 with Y_3).

Summary

My review of research on higher cognitive and probing questions indicates that we know very little about the effect of these techniques on student learning. The main effect which I have hypothesized here is that they elicit and shape thought processes, which become manifest in the quality of the student's oral answer. Before research can be done to test this hypothesis, we need to define "quality" and to develop a reliable, valid measure for rating it.

REFERENCES

Gall, Meredith D. The use of questions in teaching. Review of Educational Research, 1970, 40, 707-721.

Gall, Meredith D., Dunning, Barbara, Galassi, John, and Banks, Henry. Main field test report - Minicourse 9. San Francisco: Far West Laboratory for Educational Research and Development, 1970.

Gall, Meredith D., Dunning, Barbara, and Weathersby, Rita. Teachers handbook: Higher cognitive questioning. New York: Macmillan Educational Services, 1971.

Rosenshine, Barak. Teaching behaviours and student achievement. London: National Foundation for Educational Research in England and Wales, 1971.

Saunders, Walter, Gall, Meredith, and Smith, Gerrie. Preservice study of Minicourse 9. San Francisco: Far West Laboratory for Educational Research and Development, 1973 (report in progress).

Wright, C.J. and Nuthall, G. Relationship between teacher behaviors and pupil achievement in three elementary science lessons. American Educational Research Journal, 1970, 7, 477-493.